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Applicant: Toshihiko OHASHI et al. : Art Unit:
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FOR: POWER SUPPLY FOR VEHICLE

VERIFICATION OF A TRANSLATION

Assistant Commissioner for Patents
Washington, D.C. 20231
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I, the below named translator, hereby declare that:

1. My name and post office address are as stated below.

2. That I am knowledgeable in the English language and in the language of JP2003-193426, and I believe the attached English translation to be a true and complete translation of JP2003-193426.

3. The document for which the attached English translation is being submitted is a patent application on an invention entitled POWER SUPPLY FOR VEHICLE.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: December 26, 2007

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[NAME OF ARTICLE] Drawing 1

[NAME OF ARTICLE] Abstract 1

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[Name of the Document] Specification

[Title of the Invention] Power supply for vehicle

[Claims]

[Claim 1] A power supply apparatus for a vehicle used for braking a vehicle by electrical control, comprising an electronic controller for receiving information from a brake pedal and/or receiving information depending on the running state of the vehicle, and sending out control information for braking the vehicle to a brake, a battery for supplying electric power to the brake via the electronic controller, and an auxiliary power supply for supplying electric power to the brake via the electronic controller in case of abnormality of this battery, wherein the auxiliary power supply includes a capacitor unit formed of a plurality of capacitors, and a power supply backup unit having abnormality detecting means for detecting abnormality of this capacitor unit, and the abnormality detecting means, when charging the capacitor unit, measures the internal resistance value of the capacitor unit from the voltage determined at the time of start of charging or the voltage determined at the time of interruption by interrupting the charging, and measures the internal capacitance value of the capacitor unit from the voltage change rate per unit time of capacitor unit at the time of charging.

[Claim 2] The power supply apparatus for a vehicle of claim 1, wherein the abnormality detecting means, when discharging the capacitor unit, measures the internal resistance value of the capacitor unit from the voltage determined at the time of start of discharging or the voltage determined at the time of interruption by interrupting the discharging, and measures the internal capacitance value of the capacitor unit from the

voltage change rate per unit time of capacitor unit at the time of discharging.

[Claim 3] The power supply apparatus for a vehicle of claim 1, wherein the voltage change rate for determining the internal capacitance value of the capacitor unit is measured plural times at every specific time interval.

[Claim 4] A power supply apparatus for a vehicle, wherein abnormality detecting means, when charging a capacitor unit, measures the internal capacitance value and internal resistance value by the method of claim 1, further measures the temperature of capacitor unit at the time of charging, determines the differences between the measured internal capacitance value and internal resistance value, and the standard internal capacitance value and standard internal resistance value of the capacitor unit initialized in advance at the temperature measured at the time of charging, corrects the internal capacitance value and internal resistance value of the capacitor unit at a temperature after a specified time from the time of charging on the basis of these differences, and judges a state of deterioration of the capacitor unit by comparing the corrected internal capacitance value and internal resistance value of the capacitor unit, with a limit value of internal resistance value with respect to internal capacitance value of the capacitor unit at the temperature after the specified time initialized in advance.

[Claim 5] A power supply apparatus for a vehicle, wherein abnormality detecting means, when discharging a capacitor unit, measures the internal capacitance value and internal resistance value by the method of claim 2, further measures the temperature of capacitor unit at the time of

discharging, determines the differences between the measured internal capacitance value and internal resistance value, and the standard internal capacitance value and standard internal resistance value of the capacitor unit initialized in advance at the temperature measured at the time of discharging, corrects the internal capacitance value and internal resistance value of the capacitor unit at a temperature after a specified time from the time of discharging on the basis of these differences, and judges a state of deterioration of the capacitor unit by comparing the corrected internal capacitance value and internal resistance value of the capacitor unit, with a limit value of internal resistance value with respect to internal capacitance value of the capacitor unit at the temperature after the specified time initialized in advance.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a power supply apparatus for a vehicle for braking a vehicle electrically.

[0002]

[Background Art]

Recently, hybrid cars and electric vehicles have been rapidly developed, and braking of a vehicle has been rapidly changed from conventional mechanical braking to electrical braking, and various methods have been developed.

[0003]

Generally, for electrical control of a vehicle, a battery is used as its

power supply, but with the battery alone, if it falls in trouble and electric power cannot be supplied, the vehicle cannot be controlled, therefore it has been proposed to use an extra battery as auxiliary power supply in case of trouble of the battery.

[0004]

As prior art relating to this application, for example, patent document 1 is known.

[0005]

[Patent document 1]

Japanese Patent Unexamined Publication No. H05-116571

[0006]

[Problems to be Solved by the Invention]

However, since the auxiliary power supply is related to braking of a vehicle in case of emergency, it is extremely important that electric power should be supplied securely in the event of emergency, and it is hence equally important to predict the life of the auxiliary power supply accurately, and to detect the state of auxiliary power supply at any time.

[0007]

If a battery is used as the auxiliary power supply, it is extremely difficult to detect the end of battery life, and if the battery voltage can be detected, it is difficult to detect abnormal change of battery state by the voltage alone, and an earlier periodic replacement of battery was needed. It was thus attempted to assure a higher safety.

[0008]

If the battery can be replaced earlier and periodically, it is difficult to

check the battery state every day or upon every startup of the vehicle, and it was hard to enhance the safety further.

[0009]

The invention is devised to solve the problems of the prior art, and it is hence an object thereof to present a power supply backup unit capable of predicting the life of auxiliary power supply, and detecting its state, and thereby to realize a power supply apparatus for a vehicle of better reliability and higher safety.

[0010]

[Means to Solve the Problems]

To achieve the object, the invention as set forth in claim 1 is a power supply apparatus for a vehicle used for braking a vehicle by electrical control, including an electronic controller for receiving information from a brake pedal and/or receiving information depending on the running state of the vehicle, and sending out control information for braking the vehicle to a brake, a battery for supplying electric power to the brake via the electronic controller, and an auxiliary power supply for supplying electric power to the brake via the electronic controller in case of abnormality of this battery, in which the auxiliary power supply includes a capacitor unit formed of a plurality of capacitors, and a power supply backup unit having abnormality detecting means for detecting abnormality of this capacitor unit, and the abnormality detecting means, when charging the capacitor unit, measures the internal resistance value of the capacitor unit from the voltage determined at the time of start of charging or the voltage determined at the time of interruption by interrupting the charging, and measures the internal

capacitance value of the capacitor unit from the voltage change rate per unit time of capacitor unit at the time of charging.

[0011]

Since the capacitor unit is used as auxiliary power supply, the service life of auxiliary power supply is substantially extended, almost as long as the durability life of the vehicle, and, as a result, a maintenance-free structure is realized for power supply backup unit. Besides, the internal resistance value can be obtained from the voltage of the capacitor unit determined by interrupting the charging, and the internal capacitance value can be determined from the voltage change rate at the time of charging, so that the internal resistance value and internal capacitance value can be measured at higher precision.

[0012]

The invention as set forth in claim 2 relates to the power supply apparatus for a vehicle of claim 1, in which the abnormality detecting means, when discharging the capacitor unit, measures the internal resistance value of the capacitor unit from the voltage determined at the time of start of discharging or the voltage determined at the time of interruption by interrupting the discharging, and measures the internal capacitance value of the capacitor unit from the voltage change rate per unit time of capacitor unit at the time of discharging, and therefore the internal resistance value can be obtained from the voltage of the capacitor unit determined by interrupting the discharging, and the internal capacitance value can be determined from the voltage change rate at the time of discharging, so that the internal resistance value and internal capacitance value can be

measured at higher precision.

[0013]

The invention as set forth in claim 3 relates to the power supply apparatus for a vehicle of claim 1, in which the voltage change rate for determining the internal capacitance value of the capacitor unit is measured plural times at every specific time interval, and therefore by measuring plural times, the voltage change rate can be measured at higher precision, and the internal capacitance value of the capacitor unit can be measured accurately.

[0014]

The invention as set forth in claim 4 is a power supply apparatus for a vehicle, in which abnormality detecting means, when charging a capacitor unit, measures the internal capacitance value and internal resistance value by the method of claim 1, further measures the temperature of capacitor unit at the time of charging, determines the differences between the measured internal capacitance value and internal resistance value, and the standard internal capacitance value and standard internal resistance value of the capacitor unit initialized in advance at the temperature measured at the time of charging, corrects the internal capacitance value and internal resistance value of the capacitor unit at a temperature after a specified time from the time of charging on the basis of these differences, and judges a state of deterioration of the capacitor unit by comparing the corrected internal capacitance value and internal resistance value of the capacitor unit, with a limit value of internal resistance value with respect to internal capacitance value of the capacitor unit at the temperature after the specified time

initialized in advance.

[0015]

Accordingly, every time the power supply backup unit is charged, the internal capacitance value and internal resistance value of the capacitor unit are measured, and a state of deterioration is judged by comparing with a limit value predetermined at each temperature at every change of temperature, and the state of deterioration of capacitor unit can be checked at every time of charging, and the reliability of power supply backup unit against temperature change can be enhanced, and the safety is further enhanced for the power supply apparatus for a vehicle.

[0016]

The invention as set forth in claim 5 is a power supply apparatus for a vehicle, in which abnormality detecting means, when discharging a capacitor unit, measures the internal capacitance value and internal resistance value by the method of claim 2, further measures the temperature of capacitor unit at the time of discharging, determines the differences between the measured internal capacitance value and internal resistance value, and the standard internal capacitance value and standard internal resistance value of the capacitor unit initialized in advance at the temperature measured at the time of discharging, corrects the internal capacitance value and internal resistance value of the capacitor unit at a temperature after a specified time from the time of discharging on the basis of these differences, and judges a state of deterioration of the capacitor unit by comparing the corrected internal capacitance value and internal resistance value of the capacitor unit, with a limit value of internal

resistance value with respect to internal capacitance value of the capacitor unit at the temperature after the specified time initialized in advance.

[0017]

Accordingly, every time the power supply backup unit is discharged, the internal capacitance value and internal resistance value of the capacitor unit are measured, and a state of deterioration is judged by comparing with a limit value predetermined at each temperature at every change of temperature, and the state of deterioration of capacitor unit can be checked at every time of discharging, and the reliability of power supply backup unit against temperature change can be enhanced, and the safety is further enhanced for the power supply apparatus for a vehicle.

[0018]

[Description of the Preferred Embodiments]

(Preferred Embodiment 1)

Preferred embodiment 1 of the invention is described below while referring to the accompanying drawings.

[0019]

Fig. 1 is a block diagram of power supply apparatus for a vehicle in preferred embodiment 1 of the invention.

[0020]

In Fig. 1, reference numeral 1 is a 12-volt battery for supplying electric power to a vehicle, and power supply backup unit 2 is provided as an auxiliary power supply to this battery 1. Electronic controller 3 is provided for sending out control information for braking the vehicle, and electric power is supplied to this electronic controller 3 from battery 1 and power

supply backup unit 2. Brake pedal 4 is provided for transmitting control information for braking the vehicle to electronic controller 3, and the information from brake pedal 4 is sent to control brake 5 via electronic controller 3, and wheels 6 are braked by this brake 5.

[0021]

A specific configuration of the power supply apparatus for a vehicle of the preferred embodiment is explained. Fig. 2 is a circuit diagram of the power supply apparatus for a vehicle of the preferred embodiment.

[0022]

In Fig. 2, battery 1 is connected to IG (ignition generator) terminal 9 provided in power supply backup unit 2 via ignition switch 8 used for starting and terminating operation of the vehicle, and is also connected to +BC terminal 10 and power supply terminal 20 for supplying electric power to power supply backup unit 2 and electronic controller 3.

[0023]

Power supply backup unit 2 and electronic controller 3 are connected to each other by way of communication input terminal 11 for feeding a signal from electronic controller 3 to power supply backup unit 2, communication output terminal 12 for sending out the signal from power supply backup unit 2 to electronic controller 3, and OUT terminal 13 for sending out the detected voltage, and the electric charge collected in power supply unit 2 in case of abnormality of battery 1.

[0024]

The configuration of power supply backup unit 2 is described. Power supply backup unit 2 has capacitor unit 15 as auxiliary power supply

for supplying electric power to brake 5 via electronic controller 3 in case of abnormality of battery 1, and this capacitor unit 15 is formed of a plurality of capacitors such as electric double layer capacitors capable of charging and discharging rapidly. Power supply backup unit 2 includes charging circuit 16 for discharging this capacitor unit 15, and discharging circuit 17 for discharging, and these circuits are controlled by an instruction from microcomputer 14. Charging circuit 16 has constant current control means for keeping constant the voltage elevation of capacitor unit 15 during charging.

[0025]

Power supply backup unit 2 has voltage detecting means 18, as first detecting means, for detecting a voltage output from battery 1, and this voltage detecting means 18 includes FET switch 19 for allowing discharge to electronic controller 3 via OUT terminal 13 from capacitor unit 15 when an abnormal voltage is detected.

[0026]

Power supply backup unit 2 has second abnormality detecting means for detecting abnormality of capacitor unit 15 depending on behavior of charging and discharging, and this second abnormality detecting means include microcomputer 14, charging circuit 16, and discharging circuit 17.

[0027]

Operation of the power supply apparatus for a vehicle is explained. First, the ignition is turned on to start operation of a vehicle, and ignition switch 8 connected from battery 1 to IG terminal 9 is turned on, and a voltage 12 V is supplied into power supply backup unit 2 and electronic

controller 3 from battery 1. From electronic controller 3, a charge permit signal for permitting charging from battery 1 to capacitor unit 15 is fed to power supply backup unit 2 via communication input terminal 11, and microcomputer 14 receives the charge permit signal, and sends out to charging circuit 16. When charging is permitted, electric charge is supplied from battery 1 into capacitor unit 15 by way of +BC terminal 10 and charging circuit 16, or supplied into electronic controller 3 when battery 1 is lowered in voltage or is abnormal.

[0028]

On the other hand, a voltage output from battery 1 via +BC terminal 10 is detected by a sensor of voltage detecting means 18, and is sent out to OUT terminal 13. Herein, if the voltage output from battery 1 is more than a standard value (9.5 V), it is confirmed that the voltage from battery 1 and operation of power supply backup unit 2 are normal, and electric power is continuously supplied from battery 1 into electronic controller 3.

[0029]

Thus the vehicle operates normally, and when brake pedal 4 is pressed, electronic controller 3 receives information from brake pedal 4, and sends out control information for braking the vehicle to brake 5 on the basis of these items of information. Brake 5 is operated by the output information, and wheels 6 can be braked securely, so that the vehicle can be controlled securely.

[0030]

Thereafter, when the ignition is turned off to terminate the operation of the vehicle, ignition switch 8 connected to IG terminal 9 from battery 1 is

turned off, and supply of electric power from battery 1 is stopped. At this time, microcomputer 14 transmits a signal for instructing discharge of the electric charge accumulated in capacitor unit 15, to discharging circuit 17. On the basis of this signal, discharging circuit 17 discharges the electric charge accumulated in capacitor unit 15.

[0031]

The following is an explanation about operation of the power supply apparatus for a vehicle when battery 1 is lowered in voltage or is abnormal.

[0032]

When the vehicle starts its operation, electric charges are charged from battery 1 to capacitor unit 15, and voltage detecting means 18 detects the voltage issued from battery 1, and the voltage is sent to OUT terminal 13, and electric power is supplied from battery 1 to electronic controller 3. Voltage detecting means 18 has a sensor for detecting abnormality of battery 1, and when the voltage detected by this sensor becomes less than a standard value (9.5 V), it is detected by voltage detecting means 18 that the voltage issued from battery 1 is abnormal.

[0033]

On the basis of information of detecting the abnormality, normally-off FET switch 19 is turned on, and discharge from capacitor unit 15 to OUT terminal 13 is allowed, and supply of electric power from battery 1 is stopped. Voltage detecting means 18 sends a signal for instructing discharge of electric charges accumulated in capacitor unit 15, to microcomputer 14. By this instruction, electric charges accumulated in capacitor unit 15 are discharged to OUT terminal 13 via FET switch 19, and supplied to electronic

controller 3.

[0034]

On the other hand, if battery 1 is abnormal, this abnormality signal is sent from microcomputer 14 to communication output terminal 12, and further abnormality of battery 1 is displayed in the vehicle through electronic controller 3, and it is instructed to stop the vehicle immediately. At this time of abnormality, the electric charge accumulated in capacitor unit 15 is supplied to electronic controller 3 as emergency power supply, the driver can actuate brake 5 from brake pedal 4 via electronic controller 3, and can stop the vehicle safely.

[0035]

During operation of the vehicle, if abnormality of capacitor unit 15 is detected by second detecting means, and abnormality of capacitor unit 15 is transmitted to electronic controller 3 via communication output terminal 12, and same as in the case of abnormality of battery 1, abnormality of capacitor unit 15 is displayed. Hence, the driver may request a service company for checking or replacing of capacitor unit 15.

[0036]

The abnormality detecting method of capacitor unit 15 is explained while referring to the drawing.

[0037]

Fig. 3 is a flowchart for judging deterioration or abnormality of capacitor unit 15, Fig. 4 (a) is a voltage diagram of capacitor unit 15 at the time of charging, Fig. 4 (b) is a voltage diagram of capacitor unit 15 at the time of discharging, Fig. 5 (a) is a diagram of standard internal capacitance

value of capacitor unit 15 predetermined at each temperature, Fig. 5 (b) is a diagram of standard internal resistance value of capacitor unit 15 predetermined at each temperature, and Fig. 6 is a diagram of limit values of internal resistance value with respect to internal capacitance value of capacitor unit 15 predetermined at each temperature. An example of the preferred embodiment is explained below on the basis of the numerical values determined in Fig. 5 (a) and (b).

[0038]

First, upon start of operation of the vehicle, charging of capacitor unit 15 is started, and the temperature is measured (Fig. 3 (a)). From start of charging, the voltage charge in capacitor unit 15 is detected by voltage detecting means 18. During charging, in order to measure the internal resistance value of capacitor unit 15 at high precision, charging is interrupted for a predetermined time, for example, 80 ms. The voltage elevated by charging descends by the portion of the voltage of capacitor unit 15 due to interruption of charging as shown in Fig. 4 (a). By the difference from the descending voltage, the voltage of capacitor unit 15 is determined, and this voltage is detected by voltage detecting means 18. From this voltage and the current value at the time of charging, the internal resistance value of capacitor unit 15 is determined. After interruption of charging for 80 ms, charging is resumed, and when voltage detecting means 18 detects that capacitor unit 15 is charged up to 12 V, the charging is terminated.

[0039]

On the other hand, the internal capacitance value of capacitor unit 15 is determined by measuring the voltage change rate per unit time at the

time of charging, but even at the time of constant-current charging, due to nonlinearity of capacitor, the voltage change rate is not always constant, that is, the change is not always linear, and in order to determine a more accurate change rate, the voltage is measured repeated at specific time interval, for example, every second, and from the average of measured values, the internal capacitance value and internal resistance value are calculated (Fig. 3 (b)).

[0040]

In the example of the preferred embodiment, as shown in Fig. 5 (a), (b), the internal resistance of capacitor unit 15 at the time of charging is 130 mohms, the internal capacitance value is 10 F, and the temperature is 0 ℃.

[0041]

After charging, the internal capacitance value and internal resistance value of capacitor unit 15 may be estimated from capacitor unit 15 at the time of measurement. The method is explained below.

[0042]

At the time of charging of capacitor unit 15, this method is to determine, as shown in Fig. 5 (a), the difference between the internal capacitance value (10 F) of capacitor unit 15 determined at the time of charging and the standard internal capacitance value (14 F) at temperature 0 ℃ at the time of charging, and, as shown in Fig. 5 (b), the difference between the internal resistance value (130 mohms) of capacitor unit 15 determined at the time of charging and the standard internal resistance value (60 mohms) of capacitor unit 15 at temperature 0 ℃ at the time of charging (Fig. 3 (c)). As known from Fig. 5 (a) and (b), the difference of

internal capacitance value is 4 F, and the difference of internal resistance value is 70 mohms.

[0043]

Since the temperature of capacitor unit 15 is measured all the time (Fig.3 (d)), from the determined difference of internal capacitance value and difference of internal resistance value (4 F, 70 mohms), the internal capacitance value and internal resistance value of capacitor unit 15 are corrected at every temperature (Fig. 3 (e)). The corrected internal capacitance value and internal resistance value are compared with the limit resistance value with respect to the internal capacitance value of capacitor unit 15 determined at the temperature at the time of correction shown in Fig. 6, and judged (Fig. 3 (f)). This judgment is executed in every 5 minutes. As a result, deterioration of capacitor unit 15 can be judged.

[0044]

At this time of judgment, when the internal resistance value of capacitor unit 15 is not more than the limit value shown in Fig. 6, capacitor unit 15 is judged to be normal, but if exceeding the limit value, capacitor unit 15 is judged to be abnormal, and the abnormality is displayed in the vehicle (when judged to be normal, the process returns to step (d)).

[0045]

In the preferred embodiment, when the temperature of capacitor unit 15 is changed from 0 ℃ to 15 ℃ and 30 ℃, the internal capacitance value is shown in Fig. 5 (a) and the internal resistance value is shown in Fig. 5 (b). From the determined differences (4 F, 70 mohms), at 15 ℃, the internal capacitance value is 11 F, and the internal resistance value is 115 mohms, at

30 ℃, the internal capacitance value is 11 F, and the internal resistance value is 110 mohms.

[0046]

These obtained values are explained by referring to Fig. 6. In the preferred embodiment, as shown in Fig. 6, at 0 ℃, the limit value is 230 mohms in the case of 10F and 130 mohms, at 15 ℃, the limit value is 180 mohms in the case of 11F and 115 mohms, and at 30 ℃, the limit value is 80 mohms in the case of 11F and 130 mohms, and therefore capacitor unit 15 is judged to be normal at 0 ℃ and 15 ℃, and abnormal at 30 ℃,

[0047]

When capacitor unit 15 is judged to be abnormal, it is judged again 5 minutes later (Fig. 3 (g)), and if judged to be abnormal again, abnormality due to deterioration of capacitor unit 15 is established (Fig. 3 (h)), and abnormality due to deterioration of capacitor unit 15 is displayed in the vehicle to inform the driver of abnormality. When judged to be normal by second measurement, returning to Fig. 3 (d), measurement continues to judge deterioration again.

[0048]

In the preferred embodiment, by interrupting the charging process, the internal resistance value is determined from the descending voltage right after interruption, but it may be obtained from the ascending voltage right after assuming charging or upon start of charging.

[0049]

The preferred embodiment is based on charging method, but may be also applied in discharging method as shown in Fig. 4 (b).

[0050]

Thus, according to the preferred embodiment, every time the power supply backup unit is charged or discharged, the internal capacitance value and internal resistance value of the capacitor unit are measured at high precision, and by comparing with the limit value of internal resistance value at the temperature at the time of measurement, state of deterioration of capacitor unit can be confirmed upon every time of charging, and the reliability of power supply backup unit again temperature change can be further enhanced, and the safety as power supply apparatus for a vehicle is much more enhanced.

[0051]

[Advantage of the Invention]

As described herein, the invention has an auxiliary power supply for supplying electric power to an electronic controller of a vehicle, and this auxiliary power supply is formed of a capacitor unit, and even if the battery is abnormal, electric power can be securely supplied to the electronic controller from the auxiliary power supply, and it is possible to examine the operation state of the power supply backup unit and deterioration state of capacitor unit upon every start of vehicle operation, and a power supply backup unit of high reliability is obtained, and a power supply apparatus for a vehicle of high safety is realized.

[Brief Description of the Drawings]

Fig. 1 is a block diagram of power supply apparatus for a vehicle in a preferred embodiment of the invention.

Fig. 2 is a circuit diagram of power supply apparatus for a vehicle in the

preferred embodiment of the invention.

Fig. 3 is a flowchart for judging deterioration or abnormality of capacitor unit in the preferred embodiment of the invention.

Fig. 4 (a) is a voltage diagram of capacitor unit at the time of charging in the preferred embodiment of the invention.

Fig. 4 (b) is a voltage diagram of capacitor unit at the time of discharging in the preferred embodiment of the invention.

Fig. 5 (a) is a diagram of standard internal capacitance value of capacitor unit in the preferred embodiment of the invention.

Fig. 5 (b) is a diagram of standard internal resistance value of capacitor unit in the preferred embodiment of the invention.

Fig. 6 is a diagram of limit values of internal resistance value with respect to internal capacitance value of capacitor unit in the preferred embodiment of the invention.

[Description of the Reference Numerals and Signs]

1 Battery

2 Power supply backup unit

3 Electronic controller

4 Brake pedal

5 Brake

6 Wheel

8 Ignition switch

9 IG terminal

10 +BC terminal

11 Communication input terminal

12 Communication output terminal

13 OUT terminal

14 Microcomputer

15 Capacitor unit

16 Charging circuit

17 Discharging circuit

18 Voltage detecting means

19 FET switch

20 Power supply terminal

[Name of the Document] Abstract

[Abstract]

[Object] To present a power supply apparatus for a vehicle of high reliability and high safety, by realizing a power supply backup unit capable of predicting the service life of auxiliary power supply, and detecting the state of auxiliary power supply.

[Means to Solve the Problems] A power supply apparatus for a vehicle has power supply backup unit 2 using capacitor unit 15 formed of a plurality of capacitors, as auxiliary power supply, in which electric power is supplied to electronic controller 3 from power supply backup unit 2 as auxiliary power supply in case of abnormality of battery 1, and abnormality is detected by measuring the internal resistance value and internal capacitance value of capacitor unit 15 always during charging of power supply backup unit 2.

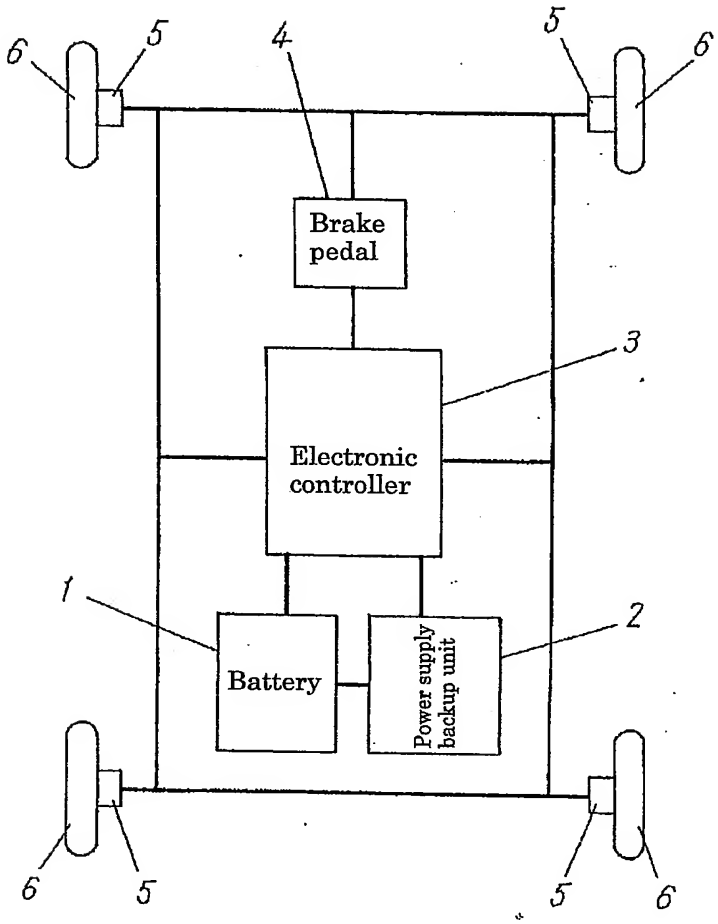
[Selected Drawing] Fig. 2

[Name of the Document] Drawing

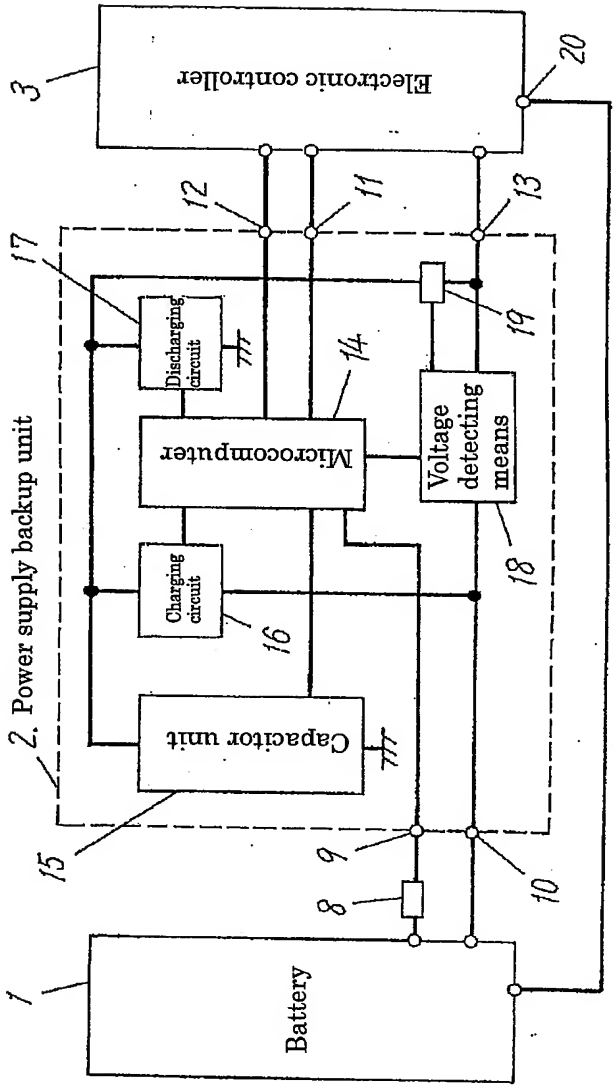
[Fig. 1]

5 Brake

6 Wheel

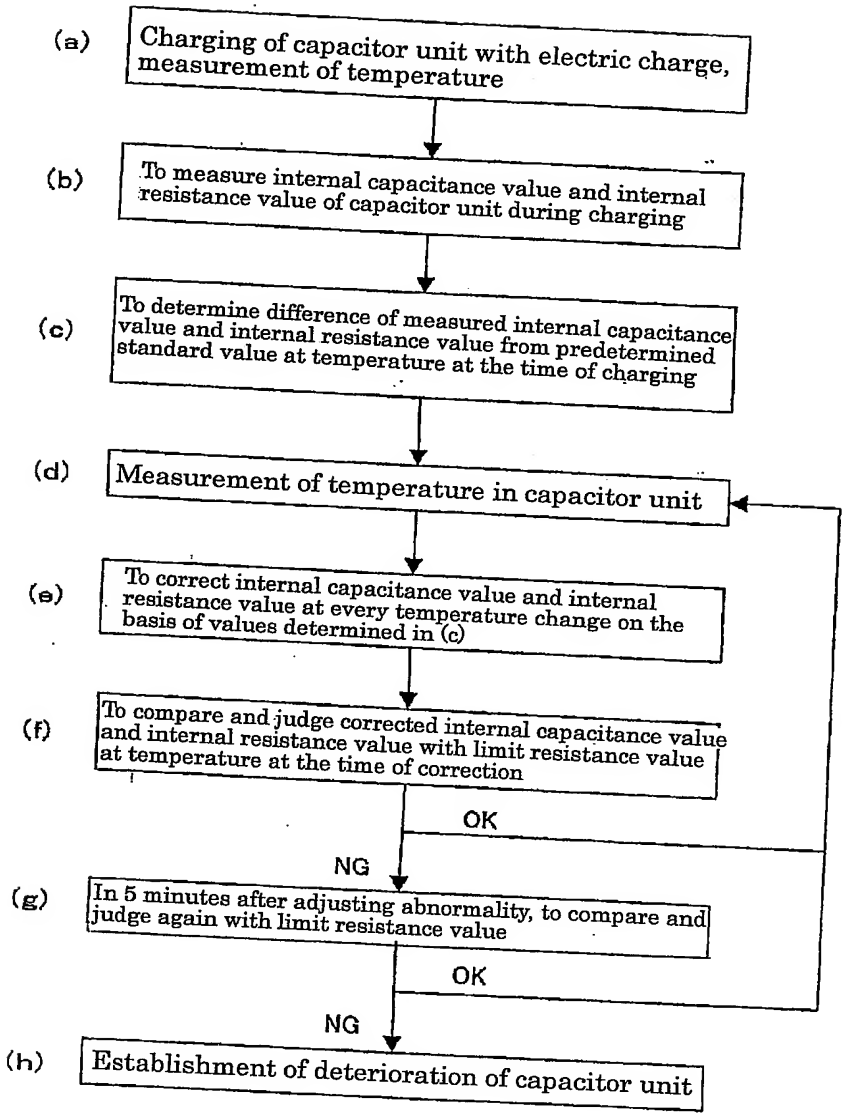


[Fig. 2]

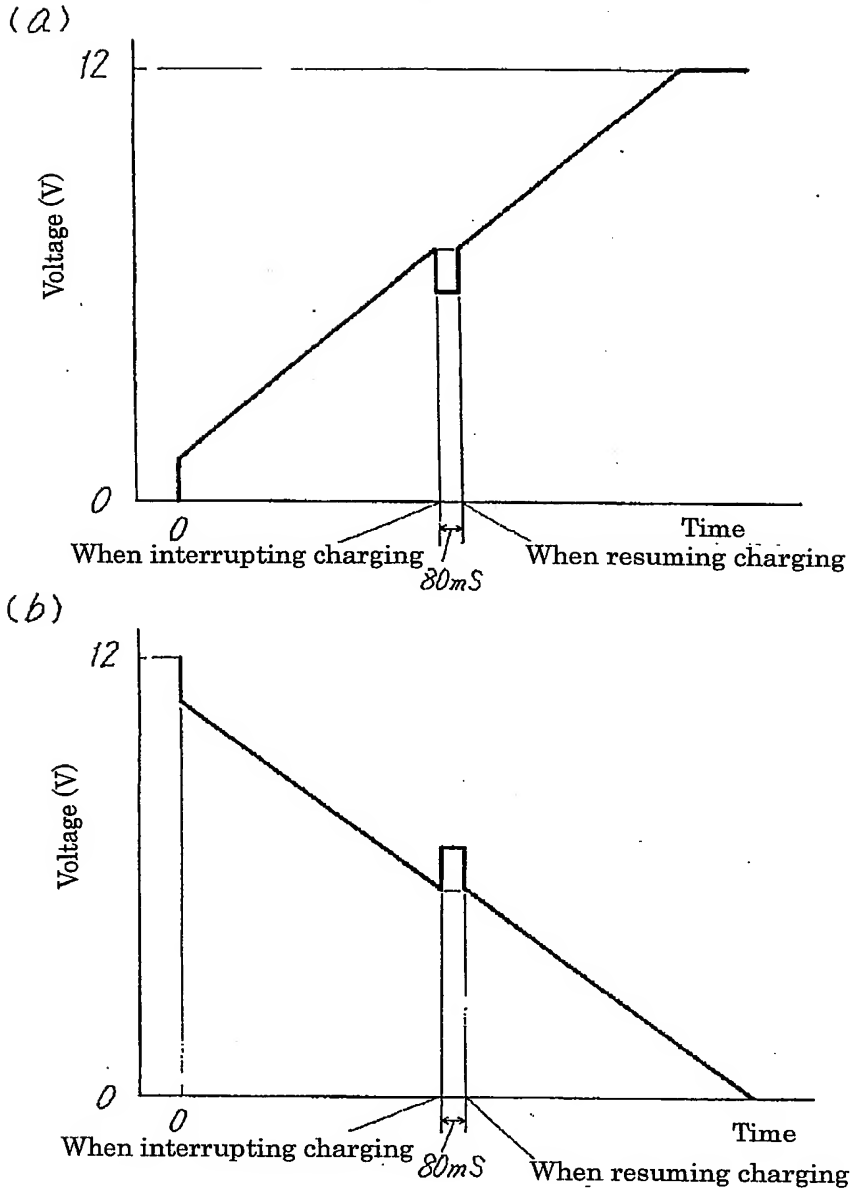


8	Ignition switch	12	Communication output terminal
9	IG terminal	13	OUT terminal
10	+BC terminal	19	FET switch
11	Communication input terminal	20	Power supply terminal

[Fig. 3]

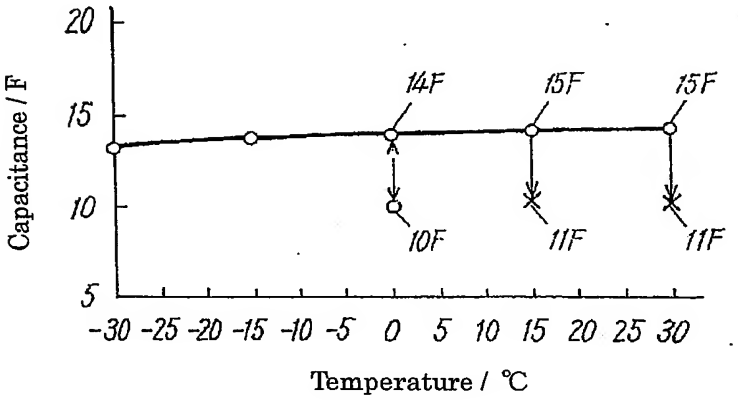

(a)
Charging of capacitor unit with electric charge, measurement of temperature
(b)
To measure internal capacitance value and internal resistance value of capacitor unit during charging
(c)
To determine difference of measured internal capacitance value and internal resistance value from predetermined standard value at temperature at the time of charging
(d)
Measurement of temperature in capacitor unit
(e)
To correct internal capacitance value and internal resistance value at every temperature change on the basis of values determined in (c)
(f)
To compare and judge corrected internal capacitance value and internal resistance value with limit resistance value at temperature at the time of correction
OK
NG
(g)
In 5 minutes after adjusting abnormality, to compare and judge again with limit resistance value
OK
NG
(h)
Establishment of deterioration of capacitor unit

[Fig. 4]

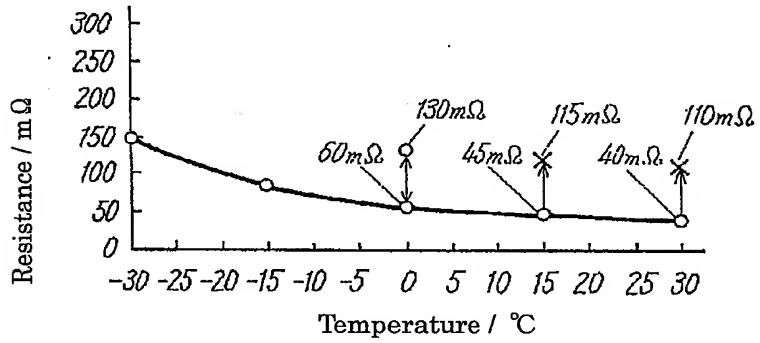

(a)
12
Voltage (V)
0
0
Time
When interrupting charging
80mS
When resuming charging
(b)
12
Voltage (V)
0
0
Time
When interrupting charging
80mS
When resuming charging

[Fig. 5]

(a) Standard internal capacitance value of capacitor unit



(b) Standard internal resistance value of capacitor unit



[Fig. 6]

Internal resistance limit value of capacitor unit